CLAIMS

What is claimed is:

1.   An end host comprising:

memory including:

executable instructions;

storage for respective identifiers for respective peers of the end host in a peer-to-peer system; and

an array for each said peer of the end host, wherein:

each said array includes one of more entries; and

each said entry:

corresponds to one neighbor peer of one peer of the end host

(NPOP); and

includes an identifier for the NPOP;

a processor for executing the executable instructions which, when executed, interacts

the end host as a peer in a peer-to-peer fashion in the peer-to-peer system.

2.   The end host as defined in Claim 1, wherein:

the storage comprises a multilevel routing table cache (MRTC);

each level in the MRTC has a maximum number of entries;

each level in the MRTC represents a segment of a number space corresponding to an

identifier of the end host;

the top level of the MRTC spans the entire number space;

each successively lower level contains successively smaller spans;

each said span in a level below the top level is a smaller segment than the entire number space;

each said span is clustered around one said identifier of a corresponding said peer;

and

the relative proximity between the peers corresponds to the respective identifiers thereof.

3.   The end host as defined in Claim 2, wherein the interaction of the end host as a peer in peer-to-peer fashion in the peer-to-peer system comprises, when a message is to be sent from the end host to a destination said peer having an identifier not found in the MRTC:

forming a message for a destination said peer for which the identifier thereof is not found in the memory, wherein the message include the identifier of the destination said peer; and

addressing the message to an intermediate said peer for which the identifier thereof:

is in the memory; and

is the proximally closest to the identifier of the destination said peer.

4.   The end host as defined in Claim 3, wherein the proximally closest said identifier of the intermediate said peer is found in a portion of the memory selected from the group consist of:

one said entry in one said array; and

the MRTC.

5. The end host as defined in Claim 2, wherein:

a message can be delivered to a destination said peer from the end host by transmission via a number of said peers that is not more than $O(\log_k N)$ in average;

k is the factor by which the spans of each said successively lower level is successively smaller; and

N is the number of said identifiers in an identifier naming space for the MRTC.

6. The end host as defined in Claim 1, wherein the interaction of the end host as a peer in peer-to-peer fashion in the peer-to-peer system comprises forming a message for delivery to a destination said peer via the one or more neighbor peers thereof.

7. The end host as defined in Claim 1, wherein the interaction of the end host as a peer in peer-to-peer fashion in the peer-to-peer system comprises:

addressing a message for transmission to each said NPOP of the peer to which the end host is unable to communicate for further transmission therefrom to the peer to which the end host is unable to communicate.

8. The end host as defined in Claim 7, wherein the message includes a new IP address of the end host when the IP address of the end host has changed.

9. The end host as defined in Claim 1, wherein the interaction of the end host as a peer in peer-to-peer fashion in the peer-to-peer system comprises registering one said identifier for the end host with each of the respective peers of the end host in the peer-to-peer system.

10.   The end host as defined in Claim 1, wherein the interaction of the end host as a peer in peer-to-peer fashion in the peer-to-peer system comprises:

establishing a communication connection between the end host and one said peer of the end host;

losing the established communication connection for a predetermined threshold;

receiving a message from the one said peer of the end host containing a new IP address of the one said peer; and

resuming, using the new IP address, the communication connection between the end host and one said peer of the end host.

11.   The end host as defined in Claim 10, wherein the message is received via one said NPOP.

12.   The end host as defined in Claim 1, wherein relative proximity between the peers in the peer-to-peer system is a function of the proximity of the respective identifiers thereof.

13.   The end host as defined in Claim 1, wherein:

each said identifier of each said peer is a numerical expression; and

relative proximity between the peers in the peer-to-peer system corresponds to numerical proximity of the respective identifiers thereof.

14.   The end host as defined in Claim 1, wherein:

each said array is a neighbor hint table (NHT); and

each said identifier for the NPOP comprises:

an IP address of the respective said NPOP;

a port number of the respective said NPOP; and

an ID generated from a public key of the respective said NPOP, wherein

relative proximity between the NPOPs is a function of the proximity of the

respective identifiers thereof.

15.   The end host as defined in Claim 1, wherein each said identifier of each said

peer comprises:

an IP address of the peer; and

an ID generated from a public key of the peer, wherein relative proximity between

the peer and other said peers in the peer-to-peer system is a function of the proximity of the

respective identifiers thereof.

16.   The end host as defined in Claim 1, wherein the entries in each said array are

ordered according to a priority of the NPOP selected from the group consisting of:

available bandwidth of the NPOP;

proximity of the NPOP to the corresponding said peer of the end host;

degree of trust between the NPOP and the corresponding said peer of the end host;

probability that the IP address of the NPOP will change; and

a combination of the foregoing.

17.   The end host as defined in Claim 1, wherein the executable instructions further comprise an architecture that includes:

logic for a kernel layer that has:

an internet protocol (IP) layer having an end-to-end mobility module for end communications between the end host and another end host in the peer to peer system; and

a transport layer on the IP layer for communications across interconnected networks of the peer-to-peer system;

logic for an application layer on the kernel layer and having:

a name resolution module for:

resolving any said identifier for a respective said peer in the peer-to-peer system to IP address; and

storing the identifier of the respective said peers of the end host in the storage; and

a notification module on the name resolution module for:

storing the identifier for each said NPOP in each said entry in each said array.

18.   The end host as defined in Claim 17, wherein the transport layer on the IP layer is a TCP UDP layer.

19.   The end host as defined in Claim 1, wherein each said peer in the peer-to-peer system is selected from the group consisting of:

a cellular telephone;

a computing device having a wired connection to the peer to peer system; and

a computing device having a wireless connection to the peer to peer system.

20.   The end host as defined in Claim 1, wherein the interaction of the end host as a peer in peer-to-peer fashion in the peer-to-peer system comprises:

receiving updates to the identifier for the NPOP for each entry in each array; and

sending an updated IP address for the end host to each peer of the end host.

21.   A peer to peer system comprising first and second means for interacting as respective peers in a peer-to-peer fashion in a peer-to-peer system, wherein each said first and second means respectively has:

one or more close peers in the peer-to-peer system, wherein each said close peer has one of more neighbor peers (NP);

means for storing one identifier for each of the one or more close peers; and

means for storing an array for each said close peer, wherein:

each said array includes one of more entries; and

each said entry:

corresponds to one said NP; and

includes an identifier for the NP.

22.   The peer-to-peer system as defined in Claim 21, wherein:

the first means is not one of the close peers of the second means; and

each said first and second means respectively further comprises:

an IP address;

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means for receiving updates to the identifier for the NP for each entry in each array; and

means for sending an update to the IP address to each close peer.

23.   The peer-to-peer system as defined in Claim 21, wherein, when the IP address of either of the first and second means has changed, said either respectively further comprises:

means for addressing a message for transmission to each said NP when communication can not be made, after a predetermined threshold, to the corresponding said close peer, wherein the message includes the changed IP address; and

means for:

receiving the message;

extracting the changed IP address from the message; and

communicating with the corresponding said close peer using the changed IP address.

24.   The peer-to-peer system as defined in Claim 21, wherein:

the first and second means are close peers one to the other;

when the IP address of the first means changes so as to cause a break in an on going communication between the first and second means for longer than a predetermined threshold, each of the first and second means further comprises:

means for addressing a message for transmission to each NP of each close peer of the other of the first and second means for delivery of the message thereto via each NP, wherein the message includes the changed IP address thereof; and

means for:

receiving the message via the NP;

extracting the changed IP address of the other of the first and second means from the message; and

resuming the on going communication using the changed IP address of the other of the first and second means.

25.   The peer-to-peer system as defined in Claim 21, wherein each of the first and second means further comprises:

means for registering an identifier thereof with each of the close peers; and

means for receiving an identifier for each of the NP of each of the close peers.

26.   The peer-to-peer system as defined in Claim 21, wherein:

the means for storing one identifier for each of the one or more close peers comprises a multilevel routing table cache (MRTC);

each level in the MRTC has a maximum number of entries;

each level in the MRTC represents a segment of a number space corresponding to an identifier of the respective first and second means;

the top level of the MRTC spans the entire number space;

each successively lower level contains a successively smaller spans;

each said span in a level below the top level is a smaller segment than the entire number space;

each said span is clustered around one said identifier a corresponding said close peer; and

the relative proximity between the close peers corresponds to the respective identifiers thereof.

27. The peer-to-peer system as defined in Claim 26, wherein for the first means, when a message is to be sent to a peer in the peer to peer system having an identifier not found in the MRTC of the first means, the first means further comprises:

means for forming a message for a destination said peer for which the identifier thereof is not found in the memory, wherein the message includes the identifier of the destination said peer; and

means for addressing the message to an intermediate said peer for which the identifier thereof:

is in the memory; and

is the proximally closest to the identifier of the destination said peer.

28. The peer-to-peer system as defined in Claim 27, wherein the proximally closest said identifier of the intermediate said peer is found in a portion of the memory selected from the group consist of:

one said entry in one said array; and

the MRTC.

29. The peer-to-peer system as defined in Claim 27, wherein:

the message can be delivered to the destination said peer from the first means by transmission via a number of said peers that is not more than $O(\log_k N)$ in average;

k is the factor by which the spans of each said successively lower level is successively smaller; and

N is the number of identifiers in an identifier naming space for the MRTC.

30.   The peer-to-peer system as defined in Claim 21, wherein each said peer is selected from the group consisting of:

a cellular telephone;

a computing device having a wired connection to the peer to peer system; and

a computing device having a wireless connection to the peer to peer system.

31.   A computer readable medium including instructions which, when executed by a computer, perform a method for interacting the computer as a peer in peer-to-peer fashion in a peer-to-peer system, the method comprising:

forming a transmission to register, at each said peer of the computer (POC) in the peer-to-peer system, an identifier for the computer;

receiving, at the computer, one of more messages from each said POC, wherein each said message contains at least one of:

an identifier for each said POC; and

an identifier for each neighbor peer of each said POC (NPOP) in the peer-to-peer system, wherein proximity between respective said peers in the peer-to-peer system is a function of the respective said identifiers thereof;

registering at the computer:

the identifier for each said POC; and

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the identifier for each said NPOP, wherein proximity between respective said peers in the peer-to-peer system is a function of the respective said identifiers thereof.

32.   The computer readable medium as defined in Claim 31, wherein each said identifier:

of each said POC comprises:

an IP address thereof; and

an ID generated from a public key thereof;

of each said NPOP comprises:

an IP address thereof;

an ID generated from a public key thereof; and

a port number thereof.

33.   The computer readable medium as defined in Claim 32, wherein:

the identifier for each said NPOP is registered at the computer in a neighbor hint table (NHT) for the corresponding POC;

each said NHT includes one of more entries; and

each said entry corresponds to one said NPOP and includes the identifier thereof;

the entries in each said NHT are ordered according to a priority of the NPOP selected from the group consisting of:

available bandwidth of the NPOP;

proximity of the NPOP to the corresponding said peer of the end host;

degree of trust between the NPOP and the corresponding said peer of the end host;

probability that the IP address of the NPOP will change; and

a combination of the foregoing.

34.   The computer readable medium as defined in Claim 31, wherein the method further comprises, when a message is to be sent from the computer to a destination said peer having an identifier not registered that the computer:

forming the message to include the identifier of the destination said peer; and

addressing the message to an intermediate said peer for which the identifier thereof:

is registered at the computer; and

is the proximally closest of said registered identifiers to the identifier of the destination said peer.

35.   The computer readable medium as defined in Claim 31, wherein the method further comprises:

receiving updates to the identifier for each said POC and NPOP; and

sending an updated IP address for the computer to each said POC and NPOP.

36.   The computer readable medium as defined in Claim 31, wherein the method further comprises addressing a message for transmission to each said NPOP of one said POC to which the computer is unable to communicate, after a predetermined threshold, for further transmission therefrom to the one said POC, wherein the message includes a new IP address of the computer when the IP address of the computer has changed.

37.   The computer readable medium as defined in Claim 31, wherein the method further comprises:

establishing a communication connection between the computer and one said POC;

losing the established communication connection for a predetermined threshold;

receiving a message from the one said POC containing a new IP address of the one said POC; and

resuming, using the new IP address, the communication connection between the computer and the one said POC, wherein the message is received via one said NPOP.

38.   The computer readable medium as defined in Claim 31, wherein the computer, each said POC, and each said NPOP is selected from the group consisting of:

a cellular telephone;

a computing device having a wired connection to the peer to peer system; and

a computing device having a wireless connection to the peer to peer system.

39.   The computer readable medium as defined in Claim 31, wherein the identifier for each said POC is registered at the computer in a storage comprising a multilevel routing table cache (MRTC);

each level in the MRTC has a maximum number of entries;

each level in the MRTC represents a segment of a number space corresponding to an identifier of the computer;

the top level of the MRTC spans the entire number space;

each successively lower level contains successively smaller spans;

each said span in a level below the top level is a smaller segment than the entire

number space; and

each said span is clustered around one said identifier a corresponding said POC.

40.   The computer readable medium as defined in Claim 39, wherein:

a message can be delivered to a destination said peer from the computer by

transmission via a number of said peers that is not more than $O(\log_k N)$ in average;

k is the factor by which the spans of each said successively lower level is

successively smaller; and

N is the number of said identifiers in an identifier naming space for the MRTC. .

41.   A method comprising:

storing, for an end host in a peer-to-peer system, identifiers for peers and the

neighbors of the peers; and

when an IP address of the end host changes, sending the changed IP address of the

end host to each said neighbor of the peer having the changed IP address; and

receiving a communication from the peer having the changed IP address at the

changed IP address of the end host.

42.   The method as defined in Claim 41, wherein the order in which the neighbors

of each said peer are stored is prioritized for faster delivery of the changed IP address of the

end host to the peer having the changed IP address.

43.   The method as defined in Claim 41, wherein the proximity of the peers from each other and the end host is a function of their respective identifiers.